

A.3 Facility Background Information Sheet

Design for the Environment

Printed Wiring Board Project Performance Demonstrations Questionnaire

Please complete this questionnaire, make a copy for your records, and send the original to:

Cheryl Keenan
Abt Associates
55 Wheeler Street
Cambridge, MA 02138

NOTE: The completed questionnaire must be returned PRIOR TO the scheduled site visit.

FACILITY AND CONTACT INFORMATION

Facility Identification

Company Name:					
Site Name:					
Street Address:					
City:		State:		Zip:	

Contact Identification

Enter the names of the persons who can be contacted regarding this survey.

Name:		
Title		
Phone:		
Fax:		
E-Mail:		

Section 1. Facility Characterization

Estimate manufacturing data for the previous 12 month period or other convenient time period of 12 consecutive months (e.g., FY94). Only consider the portion of the facility dedicated to PWB manufacturing when entering employee and facility size data.

1.1 General Information			
Size of portion of facility used for manufacturing PWBs:	sq. ft.	Number of days MHC line is in operation:	days/yr
Number of full-time equivalent employees (FTEs):		Total PWB panel sq. footage processed by the MHC process:	surface sq.ft/yr
Number of employee work days per year:	days/yr		

1.2 Facility Type

Type of PWB manufacturing facility (check one)	Independent		OEM	
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1.3 Process Type

Estimate the percentage of PWBs manufactured at your facility using the following methods for making holes conductive (MHC). Specify "other" entry.

Type of PWB Process	Percent of Total	Type of PWB Process	Percent of Total
Standard electroless copper	%	Conductive polymer	%
Palladium-based system	%	Conductive inks	\$
Carbon-based system	%	Other:	%
Graphite-based system	%	Other:	%
Non-formaldehyde electroless	%	TOTAL	100 %

1.4 General Process Line Data

Process Data	Shift			
	1	2	3	4
Number of hours per shift:				
Number of hours the MHC line is in operation per shift:				
Average surface square feet of PWB panel processed by the MHC line per shift.				

1.5 Process Area Employees

Complete the following table by indicating the number of employees of each type that perform work duties in the same process room as the MHC line for each shift and for what length of time. Report the number of hours per employee. Consider only workers who have regularly scheduled responsibilities physically within the process room. Specify “other” entry. Enter “N/A” in any category not applicable.

Type of Process Area Worker	Number of Employees per Shift				Hours per Shift per Employee in Process Area (first shift)
	Shift 1	Shift 2	Shift 3	Shift 4	
Line Operators					Hrs.
Lab Technicians					Hrs.
Maintenance Workers					Hrs.
Wastewater Treatment Operators					Hrs.
Supervisory Personnel					Hrs.
Other:					Hrs.
Other:					Hrs.
EXAMPLE	3	2	2		8 Hrs.

Section 2. General Process Data

The information in this section will be used to identify the physical parameters of the process equipment as well as any operating conditions common to the entire process line.

2.1 Process Parameters

Size of the room containing the process:	sq. ft.		
Is the process area ventilated (circle one)?	Yes	No	
Air flow rate:	cu. ft./min.		
Type of ventilation? (Check one)	General	Local	
Amount of water used by the MHC process line when operating:	gal./day		

2.2 Wastewater Characterization

Estimate the average and maximum values for the wastewater from the making holes conductive line before treatment. Enter "ND" for not detectable.

	AVERAGE	MAXIMUM
Flow	gpm	gpm
TDA	mg/l	mg/l
Ph		
Cu	mg/l	mg/l

	AVERAGE	MAXIMUM
Pd	mg/l	mg/l
Sn	mg/l	mg/l
TSS	mg/l	mg/l
TTO	mg/l	mg/l

2.3 Wastewater Discharge and Sludge Data

Wastewater discharge type: (check one)	Direct	Indirect	Zero
Annual weight (pounds) of sludge generated:			
Duration of treatment (e.g., length of time for a gallon to be treated):			
Number of employees in waste treatment:			
Hazardous chemical disposal costs (annual):			
Percent solids of sludge:			
Percentage of total quantity generated by the MHC process:			
Method of sludge recycle/disposal:	[R] - Metals Reclaimed [D] - Stabilized and Landfilled [O] - Other (specify)		
Waste treatment chemicals used for treatment of MHC process line wastewater:			
Type (Chemical Name)	Quantity (gal./yr.)		

Section 3. Process Description

3.1 Process Schematic

Fill in the table below by identifying what type of making holes conductive process (e.g., electroless copper) your facility uses. Then, using the proper key at the bottom of the page, identify which letter corresponds with the first step in your process and write that letter in the first box (see example). Continue using the key to fill in boxes for each step in your process until your entire making holes conductive process is represented. If your process is not represented by a key below, complete the chart by writing in the name of each process step in your particular making holes conductive line. Finally, consult the process automation key at bottom right and enter the appropriate type of automation for the MHC process line. If the process is partially automated, enter the appropriate process automation letter for each step in the upper right-hand corner box (see example).

Type of Process (write in process name)	Process Automation Letter (see key below right)		Process Steps of Your Facility (begin here)															
	Process Step Letter (see key below)	Ex.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
		Ex. A T																

ELECTROLESS COPPER PROCESS STEPS	GRAPHITE-BASED PROCESS STEPS	GRAPHITE-BASED PROCESS STEPS	GRAPHITE-BASED PROCESS STEPS	PROCESS AUTOMATION
[A] - Cleaner/Cleaner	[A] - Cleaner/Conditioner	[A] - Cleaner/Conditioner	[A] - Cleaner/Conditioner	TYPE OF PROCESS AUTOMATION FOR ENTIRE MHC PROCESS (Consult the key below) * If the MHC process is partially automated (option R) enter 'R' on above line. Then, for each process step in chart above, consult the key below and enter the appropriate process automation letter in the box located in the upper right-hand corner of each process step (see example).
[B] - Micro Etch	[B] - Graphite	[B] - Graphite	[B] - Graphite	
[C] - Pre-dip	[C] - Fixer	[C] - Fixer	[C] - Fixer	
[D] - Activator/Catalyst	[D] - Air Knife/Oven	[D] - Air Knife/Oven	[D] - Air Knife/Oven	
[E] - Accelerator	[E] - Post-clean Etch	[E] - Post-clean Etch	[E] - Post-clean Etch	
[F] - Electroless Copper	[F] - Anti-tarnish/ Anti-oxidant	[F] - Anti-tarnish/ Anti-oxidant	[F] - Anti-tarnish/ Anti-oxidant	
[G] - Reducer/Neutralizer	[W] - Water rinse	[W] - Water rinse	[W] - Water rinse	
[H] - Anti-tarnish / Anti-oxidant	[O] - Other (specify step)	[O] - Other (specify step)	[O] - Other (specify step)	
[W] - Water rinse				
[O] - Other (specify step)				

Process Automation Key	
[P] - Automated non-conveyORIZED	[S] - Manually controlled hoist
[Q] - Automated conveyORIZED	[T] - Manual (no automation)
[R] - Partially automated *	[V] - Other (specify)

APPENDIX A

3.2 Rinse Bath Water Usage

Consult the process schematic in Section 3.1 to obtain the process step numbers associated with each of the water rinse baths present. Enter, in the table below, the process step number along with the flow control and flow rate data requested for each water rinse bath. If the water rinse bath is part of a cascade, you need only report the daily water flow rate of one bath in the cascade.

Process Step Number ^a	Flow Control ^b	Daily Water Flow Rate ^c	Cascade Water Process Steps ^d
Example: 8	R	2,400 gal./day	8 - 6
		gal./day	
		gal./day	
		gal./day	
		gal./day	
		gal./day	
		gal./day	
		gal./day	

^a Process Step Number - Consult the process schematic in question 3.1 and enter the process step number of the specific water rinse tank.

^b Flow Control - Consult key at right and enter the letter for the flow control method used for that specific rinse bath.

^c Daily Water Flow Rate - Enter the average daily flow rate for the specific water rinse tank.

^d Cascade Water Process Steps - Enter the process step number for each water rinse tank in cascade with the present tank.

Flow Control Methods Key

[C] - Conductivity Meter

[P] - pH Meter

[V] - Operator control valve

[R] - Flow Restrictor

[N] - None (continuous flow)

[O] - Other (explain)

3.3 Rack or Conveyor Cleaning

Complete the following table for your rack cleaning chemicals (for non-conveyorized MHC processes) or for conveyor cleaning equipment.

Are chemicals listed below used in rack cleaning or conveyor cleaning?		Rack		Conveyor	
Chemical	Grade	Quantity used per year			
		gal.			
		gal.			
		gal.			

3.4 Process History (complete only if you have changed from one system to another)

Complete the table below by indicating what making holes conductive process (es) your facility has employed in the past. In the second table, indicate the reasons for the process change and estimate or quantify, if possible, how the change has had an effect upon production.

FORMER MAKING HOLES CONDUCTIVE PROCESS	DATE OF CHANGE TO CURRENT PROCESS
ELECTROLESS COPPER	
PALLADIUM-BASED	
GRAPHITE-BASED	
CARBON-BASED	
COPPER SEED	
ELECTROLESS NICKEL	
OTHER (specify)	

REASONS FOR CHANGE AND RESULTS			
Reason (check all that apply)		Prior to this System ^a	Present System
	Water Consumption	gal/day	gal/day
	Process Cycle-Time	min/cycle	min/cycle
	Cost	\$/ft ²	\$/ft ²
	Worker Exposure (provide monitoring data if available)		
	Performance (provide data on changes in rejection rate, number of cycles before failure, etc.)		
	Customer Acceptance		
	Product Quality		
	Process Maintenance		
	Other:		
	Other:		
	Other:		

^a If no quantitative information is available, enter [B] - Better, [W] - Worse, [N] - No change.

Section 4. Palladium-Based Process

The information requested below will allow us to generate an exposure assessment and risk characterization profile for each of the following baths and the associated activities involved in the operation and upkeep of the palladium-based process.

4.1 Physical, Process, and Operating Conditions

Complete the table below by entering the data requested for each specific type of chemical bath listed. If two tanks of the same type are used within the process, list the data for a single tank only.

BATH	LENGTH (inches)	WIDTH (inches)	NOMINAL VOLUME
CLEANER/ CONDITIONER	in.	in.	gal.
PRE-DIP	in.	in.	gal.
ACCELERATOR	in.	in.	gal.
ENHANCER	in.	in.	gal.
POST-CLEAN ETCH	in.	in.	gal.
ANTI-TARNISH/ ANTI-OXIDANT	in.	in.	gal.
OTHER (specify)	in.	in.	gal.
	in.	in.	gal.
	in.	in.	gal.
	in.	in.	gal.

4.2 Initial Chemical Bath Make-Up Composition

Complete the chart below for each chemical component of the bath type listed. Provide the manufacturer name if the chemical used is known only by trade name. If more room is needed, please attach another sheet with the additional information. If two tanks of the same type are used within the process, list the data for a single tank only.

BATH		CHEMICAL NAME	MANUFACTURER (if applicable)	ANNUAL QTY. USED ^a (gallons)
CLEANER/ CONDITIONER	1.			
	2.			
	3.			
	4.			
PRE-DIP	1.			
	2.			
	3.			
	4.			
PALLADIUM CATALYST	1.			
	2.			
	3.			
	4.			
ACCELERATOR	1.			
	2.			
	3.			
	4.			
ENHANCER	1.			
	2.			
	3.			
	4.			

^a Annual Quantity Used - If the amount of a particular chemical used is measured by weight (i.e., crystalline chemicals) instead of volume, enter the weight in pounds and clearly specify the units (lbs.).

APPENDIX A

4.2 Initial Chemical Bath Make-Up Composition - CONTINUED

BATH		CHEMICAL NAME	MANUFACTURER (if applicable)	ANNUAL QTY. USED ^a (gallons)
POST-CLEAN ETCH	1.			
	2.			
	3.			
	4.			
ANTI-TARNISH/ ANTI-OXIDANT	1.			
	2.			
	3.			
	4.			
OTHER (specify)	1.			
	2.			
	3.			
	4.			

^a Annual Quantity Used - If the amount of a particular chemical used is measured by weight (i.e., crystalline chemicals) instead of volume, enter the weight in pounds and clearly specify the units (lbs).

4.3 Chemical Bath Replacement

Complete the chart below by providing information on the process of replacing, treating, and disposing of a spent chemical bath.

Bath Type	Criteria for Replacement ^a	Frequency ^b	Tank Cleaning Method ^c	Duration of Replacement Procedure ^d	Personal Protective Equipment ^e	Chemicals Used in Tank Flush ^f		Method of Treatment or Disposal ^g	Annual Volume Treated or Disposed ^h	New Bath Make-Up Method ⁱ
Cleaner/Conditioner						Name:	gal/yr.			
Pre-Dip						Name:	gal/yr.			
Palladium Catalyst						Name:	gal/yr.			
Accelerator						Name:	gal/yr.			
Enhancer						Name:	gal/yr.			
Post-Clean Etch						Name:	gal/yr.			
Anti-Tarnish/Anti-Oxidant						Name:	gal/yr.			
Other (specify)						Name:	gal/yr.			

^a Criteria for Replacement - Consult the key at right and enter the letter for the criteria typically used to determine when bath replacement is necessary.

^b Frequency - Enter the average amount of time elapsed or number of square feet processed between bath replacements. Clearly specify units (e.g., hours, sq. ft., etc.).

^c Tank Cleaning Method - Consult the key at right and enter the letters for the method typically used to clean the tanks.

^d Duration of Replacement - Enter the elapsed time from the beginning of bath removal until the replacement bath is finished.

^e Personal Protective Equip. - Consult key at right and enter the letters of all the protective equipment worn by the workers physically replacing the spent bath.

^f Chemicals Used in Tank Flush - enter the name of any chemicals used to clean the tanks (including water) and estimate the yearly amounts used.

^g Methods of Treat. or Disp. - Consult keys at right and enter the letter of the method used.

^h Annual Voll. Treat. or Disp. - Enter th yearly amount of the specific bath treated or disposed.

ⁱ New Bath Make-Up Method - Consult the key at right and enter the letter for the method used to fill the tanks with new bath.

Personal Protective Equipment

[E] - Eye protection [G] - Gloves
 [L] - Labcoat/Sleeved garment [A] - Apron
 [R] - Respiratory protection [B] - Boots
 [Z] - All except respiratory [N] - None protection

Tank Cleaning Method

[C] - Chemical Flush [H] - Hand Scrub
 [W] - Water Rinse [O] - Other (specify)

Criteria for Bath Replacement

[S] - Statistical process control [T] - Time
 [P] - Panel sq. ft. processed [O] - Other (specify)
 [C] - Chemical testing

Method of Treatment or Disposal

[P] - Precipitation pretreatment on-site
 [N] - pH neutralization pretreatment on-site
 [S] - Disposed directly to sewer with no treatment
 [D] - Drummed for off-site treatment or disposal
 [RN] - Recycled on-site
 [RF] - Recycled off-site
 [O] - Other (specify)

New Bath Make-Up Method

[PA] - Pumped automatically
 [PM] - Pumped manually
 [R] - Poured
 [S] - Scooped (solid)
 [O] - Other (specify)

APPENDIX A

4.4 Chemical Bath Additions

Complete the following chart detailing the typical chemical additions that are made to maintain the chemical balance of each specific process baths. If more than four chemicals are added to a specific bath, attach another sheet with the additional information. If chemical additions to a bath are made automatically, do not complete the last three columns for that bath. If two tanks of the same type are used within the process, list the data for a single tank only.

Bath Type	Chemical Added	Frequency ^a	Method of Chemical Retrieval From Stock ^b	Chemical Container Type ^c	Method of Chemical Addition to Tank ^d	Duration of Addition ^e (minutes)	Personal Protective Equipment ^f
CLEANER/ CONDITIONER	1.						
	2.						
	3.						
	4.						
PRE-DIP	1.						
	2.						
	3.						
	4.						
PALLADIUM CATALYST	1.						
	2.						
	3.						
	4.						
ACCELERATOR	1.						
	2.						
	3.						
	4.						

^a Frequency - Enter the average amount of time elapsed or number of square feet processed between bath replacements. Clearly specify units (e.g., hours, sq. ft., etc.).

^b Method of Chemical Retrieval from Stock - Consult the key at right and enter the letter for the method used to obtain chemicals from the stock for addition to the tanks.

^c Chemical Container Type - Consult the key at right and enter the letters for the type of container used to transfer chemicals from stock to the tanks.

^d Method of Chemical Addition to Tank - Consult the key at right and enter the letters for the method typically used to add chemicals to the tanks.

^e Duration of Addition - Enter the average elapsed time from the retrieval of the chemical stock through the completion of the addition of all chemicals.

^f Personal Protective Equipment - Consult key at right and enter the letters of all the protective equipment worn by the workers physically replacing the spent bath.

Method Chemical Retrieval Key

[P] - Pumped
[PR] - Poured
[S] - Scooped
[O] - Other

Container Type

[OT] - Open-top
[CT] - Closed-top
[SC] - Safety container
[O] - Other (specify)

Method of Chemical Addition Key

[A] - Automatic ^a
[P] - Pumped manually
[PR] - Poured
[S] - Scooped
[O] - Other (specify)

*** If additions are automatic [A] then do not complete the last two columns.**

Personal Protective Equipment Key

[E] - Eye protection
[L] - Labcoat/Sleeved garment protection
[B] - Boots
[Z] - All except respiratory
[G] - Gloves
[A] - Apron
[R] - Respiratory protection
[N] - None

4.4 Chemical Bath Additions - CONTINUED

Bath Type		Chemical Added	Frequency ^a	Method of Chemical Retrieval From Stock ^b	Chemical Container Type ^c	Method of Chemical Addition to Tank ^d	Duration of Addition ^e (minutes)	Personal Protective Equipment ^f
CLEANER/ CONDITIONER	1.							
	2.							
	3.							
	4.							
PRE-DIP	1.							
	2.							
	3.							
	4.							
PALLADIUM CATALYST	1.							
	2.							
	3.							
	4.							
ACCELERATOR	1.							
	2.							
	3.							
	4.							

^a Frequency - Enter the average amount of time elapsed or number of square feet processed between bath replacements. Clearly specify units (e.g., hours, sq. ft., etc.).

^b Method of Chemical Retrieval from Stock - Consult the key at right and enter the letter for the method used to obtain chemicals from the stock for addition to the tanks.

^c Chemical Container Type - Consult the key at right and enter the letters for the type of container used to transfer chemicals from stock to the tanks.

^d Method of Chemical Addition to Tank - Consult the key at right and enter the letters for the method typically used to add chemicals to the tanks.

^e Duration of Addition - Enter the average elapsed time from the retrieval of the chemical stock through the completion of the addition of all chemicals.

^f Personal Protective Equipment - Consult key at right and enter the letters of all the protective equipment worn by the workers physically replacing the spent bath.

**Method Chemical
Retrieval Key**

[P] - Pumped
[PR] - Poured
[S] - Scooped
[O] - Other

Container Type

[OT] - Open-top
[CT] - Closed-top
[SC] - Safety container
[O] - Other (specify)

Method of Chemical Addition Key

[A] - Automatic ^a
[P] - Pumped Manually
[PR] - Poured
[S] - Scooped
[O] - Other (specify)

*** If additions are automatic [A] then
do not complete the last two columns.**

**Personal Protective Equipment
Key**

[E] - Eye protection
[L] - Labcoat/Sleeved garment
protection
[B] - Boots
[Z] - All except respiratory
[G] - Gloves
[A] - Apron
[R] - Respiratory protection
[N] - None

APPENDIX A

4.5 Other Bath Related Activities

Complete the following table for any other bath related activities that your facility engages in.

BATH TYPE	TYPE OF ACTIVITY (Describe)	FREQUENCY ^a	DURATION OF ACTIVITY ^b	NUMBER OF PEOPLE ^c	PROTECTIVE EQUIPMENT
CLEANER/ CONDITIONER					
PRE-DIP					
CATALYST					
ACCELERATOR					
ENHANCER					
POST-CLEAN ETCH					
ANTI-TARNISH/ ANTI-OXIDANT					
OTHER (specify)					

^a Frequency - Enter the average amount of time elapsed or number of panel sq. ft. processed since the last time the activity was performed. Clearly specify units (e.g., hours, square feet, etc.).

^b Duration of Activity - Enter the average time for performing the specified activity. Clearly specify units.

^c Personal Protect. Equip. - Consult key on the previous page and enter the letters for all protective equipment worn by the people performing the activity.